SECTION 02736
GRINDER SEWAGE PUMP STATION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install two (2) duplex grinder pump stations, each station consisting of two grinder pump units; control panel; slide rail and pump mounting plate, complete with upper guide rail bracket and discharge elbow; stainless steel lifting system; discharge piping; and wet well basin and valve vault at the locations shown on the Drawings.

B. The service and operating conditions of the pumps are shown in paragraph 2.2.B.

C. See Drawings USS6.34.04 and USS6.34.05 for dimensions, elevations and additional requirements.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions apply to this Section.

B. Section 02600 – Manholes.

C. Section 02642 – Pressure Sewer Valves.

D. Section 02733 – Sewage Force Main.

1.3 SUBMITTALS

A. Submit shop drawings for all products specified in this section in accordance with the requirements of General and Supplementary Conditions.

B. Pump Startup and Flow Test Report

C. Manufacturer’s Certification of proper installation

1.4 WARRANTY

A. The manufacturer shall warrant its product to be free from defects in material and factory workmanship for a period of 1 year from the date of acceptance. Repair of parts replacement required as a result of such defects will be made free of charge during this period.

B. The manufacturer shall provide the General Contractor specific instruction on the assembly and installation of the pump stations and related equipment.

C. The manufacturer will furnish, at his own expense, the services of a factory trained serviceman to instruct the Owner's personnel in the operation and maintenance of the pumps and related equipment. The individual performing the instruction to the Owner shall be trained and/or certified by the manufacturer as its authorized operation, maintenance, and service specialist. Allow a minimum of 1 day for this instruction. The schedule of the visit shall be approved by the CM.

PART 2 - PRODUCTS

2.1 PUMP COMPONENTS

A. General
1. The pump and motor control panel shall be by the same manufacturer so as to insure suitability and assurance of experience in matching the equipment together and to insure single source responsibility for the equipment.

2.2 PUMPS

A. General
1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide a total of four (4) submersible centrifugal sewage grinder pumps.
2. The contractor shall supply two (2) control panels, which contains all necessary components for proper starting and operation of the pumps. The panels shall provide a circuit that monitors the seal sensors, heat sensors in the pumps.
3. Pumps shall be equipped with stainless steel nameplate.

B. Operating Conditions
1. Each pump shall be rated 5.0 H.P., 460 volts, 3 phase, 60 hertz, and 3500 R.P.M. The pump motor shall be non-overloading over the entire operating range of the impeller supplied.
2. The pumps shall have the following capacities:
   a. P-GP-01 and P-GP-02 (Front End Building, Drawing USS6.34.04) – 28 GPM at 50 feet TDH (each).
   b. P-GP-03 and P-GP-04 (CNMS, Drawing USS6.34.05) – 102 GPM at 40 feet TDH (each).

C. Construction
1. Design Basis:
   a. P-GP-01 and P-GP-02: Hydromatic Model HPGFH 500.
   b. P-GP-03 and P-GP-04: Hydromatic Model HPGHH 500.
2. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a 2" NPT flange. All external-mating parts shall be machined and Buna N Rubber O-ring sealed on a beveled edge. All fasteners exposed to the pumped liquids shall be 300 series stainless steel.

D. Electrical Power Cord
1. Electrical power cord shall be STW-A, water resistant 600 V, 60°C., UL and CSA listed and applied dependent on amp draw for size.
2. The power cable entry into the cord cap assembly shall first be made with a compression fitting. Each individual lead shall be stripped down to bare wire at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary attraction.
3. The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with a screwed wire to wire connection, rather than a terminal board that allows for possible leaks.
4. There shall be an addition epoxy compound potting area separating the motor housing from the cord cap assembly.
5. The cord cap assembly where bolted to the connection box assembly and the connection box assembly where bolted to the motor housing shall each be sealed with a Buna N Rubber O-ring on a beveled edge to assure proper sealing.
6. The power cord shall be continuous with no splices from the motor to the control panel.

E. Motor
   1. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation, (155°C or 311°F), and a dielectric oil filled motor, NEMA B design (3 Ø). Further protection shall be provided by on winding thermal sensors. Because air-filled motors do not dissipate heat as efficiently as oil-filled motors, they shall not be acceptable.
   2. The pump and motor shall be specifically designed so that they may be operated completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Dependence upon, or use of, water jackets for supplemental cooling shall not be acceptable.
   3. Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed in the field without the use of heat or a press. Stators held by a heat shrink fit shall not be acceptable. Stators must be capable of being repaired or rewound by local motor service station. Units that require service only by the factory shall not be acceptable. No special tools shall be required for pump and motor disassembly.
   4. Pump shall be equipped with heat sensors. The heat sensors shall be a low resistance; bi-metal disc that is temperature sensitive. It shall be mounted directly on the stator windings and sized to open at 120°C and automatically reset at 30-35°C differential. The sensors shall be connected in series with motor starter coil so that the pump cease operation when an over-temperature condition is sensed. The starter shall be equipped with 3-leg overload relay with heaters sized for the pump's full load amps. The pump shall cease operation when the overload is tripped. The overload shall be manually reset.

F. Bearings and Shaft
   1. An upper radial bearing and a lower thrust bearing shall be required. These shall be permanently lubricated by the dielectric oil that fills the motor housing.
   2. The shaft shall be machined from a solid 416 stainless steel bar and is a design that is of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life.

G. Seals
   1. The pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals. The upper seal shall be a John Crane Type 21, BF1C1; seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be a John Crane Type 6A BP892. The seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminates out of the seal area. Units that require the use of foreign manufactured seals shall not be acceptable. Seals shall be locally available.
   2. The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.
   3. There shall be an electric probe or seal failure sensor installed in the seal chamber between the two tandem mechanical seals. If the lower seal fails, contaminants which enter the seal chamber shall be detected by the sensor and send a signal to operate the specified warning device.
   4. Units equipped with opposed mechanical seals shall not be acceptable.

H. Impeller
   1. Impeller shall be bronze multi-vane, semi-open non-overloading design and have pump-out vanes on the backside of the impeller to prevent grit and other materials from collecting in the seal area. The impeller shall be designed so that it can be factory or field trimmed to meet specific performance conditions. Wear or field trimming shall not deter the factory balance.
   2. Impellers shall be dynamically balanced.

I. Casing
   1. The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the vertical discharge type. A rail system to allow easy installation and removal of the pump shall be available. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.

J. Grinder Cutters
   1. The combination centrifugal impeller and grinder unit shall be attached to the common motor and pump shaft made of 416 stainless steel. The grinder unit shall be on the suction side of the pump impeller and discharge directly into the impeller inlet leaving no exposed shaft to permit packing of ground solids. The grinder shall consist of two stages. The cutting action of the second stage shall be perpendicular to the plane of the first cut for better control of the particle size. The grinder shall be capable of grinding all materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry with a particle dimension no greater than ¼ inch. Both stationary and rotation cutters shall be made of 440C stainless steel hardened to Rockwell 60 C and ground to close tolerance.
   2. The upper (axial) cutter and stationary cutter ring shall be reversible to provide new cutting edges to double life. The stationary cutter ring shall be a slip fit into the suction opening of the volute and held in place by three (3) 300 series stainless steel screws and retaining ring. The lower (radial) cutter shall macerate the solids against the I. D. of the cutter ring and extrude them through the slots of the cutter ring. The upper (axial) cutter shall cut off the extrusions, as they emerge from the slots of the cutter ring to eliminate any roping effect, which may occur in single stage cutting action. The upper (axial) cutter shall fit over the hub of the impeller and the lower (radial) cutter shall slip fit and be secured by means of peg and hole and rotate simultaneously with the rotation of the shaft and impeller. A 300 series stainless steel countersunk washer in conjunction shall lock the grinding mechanism to the shaft with a 300 series stainless steel flat head cap screw threaded into the end of the shaft.

K. Painting
   1. The pump shall be painted after assembly, and testing, with a dark green water reducible air dry enamel. The paint shall be applied in one coat covering all exterior surfaces. The pump shall be air dried after testing and before painting.

L. Serviceability
   1. The complete rotating assembly shall be capable of being removed from the volute without disturbing discharge piping or volute. The motor housing, seal housing with seal plate and impeller still attached to the shaft shall be capable of being lifted out of the volute case from the top as one assembly.

M. Testing
   1. Commercial testing shall be required and include the following:
      a. The pump shall be visually inspected to confirm that it is built in accordance with the specification as to HP, voltage, phase and hertz.
      b. The stator motor leads shall be tested for integrity using a megohmeter at the highest setting.
      c. Pump shall be allowed to run dry to check for proper rotation.
      d. Discharge piping shall be attached; the pump submerged in water and amp readings shall be taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalanced resistance exists. If so, the stator shall be replaced.

e. The pump shall be removed from the water, megohmeter tested again, dried and the motor housing filled with dielectric oil.

2.3 CONTROL PANEL

A. General

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide two (2) duplex motor control panels as specified herein.
2. The motor control panel shall be assembled and tested by a shop meeting U.L. Standard 508 for industrial controls and shall bear a UL label. The motor and control panel shall be assembled and tested by the same manufacturer supplying the pump so as to insure suitability and assurance of experience in matching controls to motors and to insure single source responsibility for the equipment.
3. The control panel shall comply with the NEC regulations. The panel shall contain all components required by the pump manufacture for starting and protection of the motor. Any features required by the pump manufacture for warranty of the pump shall be included in the control panel.

B. Construction

1. The controls for the pump shall be contained in a stainless steel enclosure meeting NEMA 4X requirements with a hinged door and neoprene gasket. Provide one o-ring seal for each cord and conductor penetration at the bottom of the control panel. Mount panel on vented stainless steel pedestal.
2. The enclosure shall have provisions for padlocking. A nameplate shall be permanently affixed to the panel and include the model number, voltage, phase, hertz, ampere rating and horsepower rating. A warning label against electric shock shall be permanently affixed to the outer door
3. A steel back panel with electroplated bright zinc and clear chromate finish shall be provided. A painted steel back panel will not be acceptable.
4. Run lights and hand-off-auto switches shall be provided. Run light and hand-off-auto switch shall be mounted on an electroplated bright zinc with clear chromate finish steel bracket. The run light and hand-off-auto switch shall be properly labeled as to function. The hand-off-auto switch shall be rocker type with an electrical life of 50,000 operations. The run light shall match the hand-off-auto switch in appearance and have an electrical life of 5,000 hours. Run light shall be red.
5. Terminal blocks with box type lugs shall be supplied to terminate all wiring for floats and heat and seal sensors for the pump, if required. The pump leads shall be terminated at the overload relay or at box type terminal blocks. The terminal blocks for the float connections shall be on the pump controller.
6. A circuit breaker shall be used to protect from line faults and to disconnect the pump from the incoming power. Circuit breaker shall be thermal magnetic and sized to meet NEC requirements for motor controls.
7. The magnetic starters shall include a contactor with a minimum mechanical life of 3,000,000 operations and a minimum contact life of 1,000,000 operations. A definite purpose contactor shall not be acceptable. The magnetic starter shall include an overload relay which is ambient temperature compensated and bimetallic. The overload relay shall have test and reset buttons. The overload relay shall be capable of being set in either manual or automatic reset mode. In the manual mode, reset shall be accomplished only by the operator. At 6 times full load amps the overload relay shall trip within 10 seconds or Class 10 rated overload relays shall be required.
8. Control voltage shall be 120 VAC and may be accomplished by the means of a transformer or available line voltage. A control fuse and on/off switch shall protect and isolate the control voltage from the line. The control transformer shall be sized to include the convenience acceptable.
9. Wire ties shall be used to maintain panel wiring in neat bundles for maintenance and to prevent interference with operating devices. All wiring shall be color coded to facilitate

maintenance and repair of the control panel. Where a color is repeated, number coding shall be added. A schematic shall be permanently attached to the inside surface of the front door.

10. All ground connections shall be made with ring tongue terminals and star washers to assure proper ground.
11. A duplex pump controller shall be provided for control logic. Pump controller shall be solid state utilizing a printed circuit board to avoid conventional wiring. The printed circuit board of the pump controller shall be made of U.L. listed materials.
12. The pump controller shall indicate float circuit operations utilizing red amber LED indicator lights. LED indicator lights shall provide adequate information so that they can be used for diagnosis in troubleshooting problems located in the float circuits. Each LED shall be permanently labeled on the pump controller as to function.
13. Pump controller shall have provisions for connecting float level controls and heat sensor monitors, where applicable, to box type lug connectors.
14. Box type lug connectors shall be made of polyamide thermoplastic to exclude aging due to heat influences. Phenolic type terminal blocks on the pump controller shall not be acceptable. Each terminal block shall be property and permanently labeled on the pump controller as to its purpose.
15. Wiring of hand-off-auto switch, run light, contactor, and overload to the pump controller shall be accomplished by means of plug connectors. The pump controller shall have male header assemblies from the corresponding devices as labeled on the pump controller for that male header assembly. Header assemblies shall be constructed of a corrosion-resistant thermoplastic material having a temperature range of -55 °C to 105 °C and copper alloy, bright acid tin over nickel plating contacts.

C. Sump Level Controls
   1. Float switches shall be supplied to control sump level and alarm signal. The switches shall be sealed in a solid polypropylene float for corrosion and shock resistance. The support wire shall have a heavy Neoprene jacket. A weight shall be attached to cord above the float to hold switch in place in sump and efficiently prevent sharp bends in the cord when the float operates. A quantity of five (5) floats shall be provided to control level. Float cords shall be continuous, with no splices from the float to the control panel.

D. Operation Of System
   1. On sump level rise lower switch shall first be energized, then upper level switch shall next energize and start lead pump. With lead pump operating, sump level shall lower to low switch turn-off setting and pump shall stop. Alternating relay shall index on stopping of pump so that lag pump will start first on next operation and become lead pump. If sump level continues to rise when lead pump is operating, override switch shall energize and start lag pump. Both lead and lag pump shall operate together until low level switch turns off both pumps. If level continues to rise when both pumps are operating, alarm switch shall energize and signal the alarm. If one pump should fail for any reason, the second pump shall operate on the override control and if level rises above override control, alarm shall signal. All level switches shall be adjustable for level setting, from the surface. If the low switch shall fail to shut the pump(s) off, the level shall drop to the low alarm switch level, which shall activate the alarm light and horn and shut off both pumps.

E. Options
   1. Panel shall be equipped with the following additional features.
      a. U.L. 508, intrinsically safe circuit extensions for floats.
      b. High level alarm light (Flashing)
      c. High-level alarm horn with push to silence switch.
      d. Low water alarm
      e. Seal failure lights, one each pump
      f. Phase failure protection
      g. Lightning suppresser

h. 110 volt convenience outlet, 15 amp
i. Swing dead front door with non-fused disconnect
j. Main Circuit Breaker on supply powerline, externally operable

F. Remote Monitoring
1. Provide the following isolated output signals to the site instrumentation system (each control panel)
a. Pump Alarm – Float leakage sensor, motor thermal overload or circuit breaker trip, one common alarm each pump
b. Wetwell Level Alarm, High or Low Level, one common alarm
c. Pump Station Power Status – On/Off
2. Pump Control Panel Supplier shall be responsible to provide outputs compatible with site instrumentation system.
3. Provide terminal strip for connection to site system.

PART 3 - EXECUTION

3.1 Install the grinder sewage pump stations as shown on the Drawings and in accordance with the manufacturer's recommendations.

3.2 Obtain the services of the manufacturer's service engineer to check the installation of each grinder sewage pump station and make any field adjustments necessary to ensure proper operation. The service engineer shall certify to the CM in writing that the equipment has been satisfactorily installed, adjusted, and is ready for operation.

3.3 Conduct a pump start-up and flow test in the presence of the CM to demonstrate proper operation of the pump station. Submit a pump startup and flow test report containing all data from the test.

END OF SECTION 02736